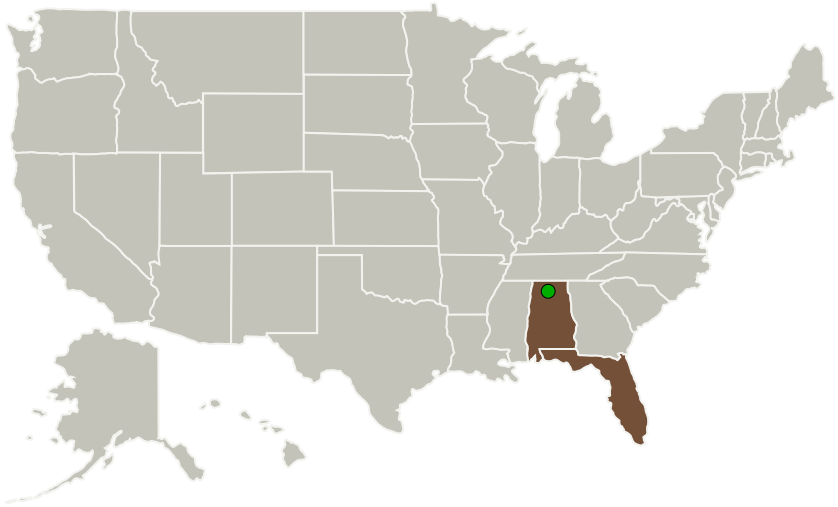
Bi-Metallic Additive Manufacturing Close-Out of Coolant Channels for Large Liquid Rocket Engine (LRE) Nozzles, Phase I

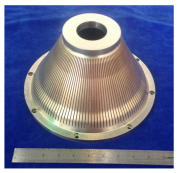
Completed Technology Project (2016 - 2017)

Project Introduction

This NASA sponsored STTR project will investigate methods for close-out of large, liquid rocket engine nozzle, coolant channels utilizing robotic laser and pulsed-arc additive manufacturing methods. Copper to Nickel alloy interface strength will be quantified and metallurgical characterization completed. A thermal model based on Rosenthal?s analytical expression for a moving heat source, which has been incorporated into a numerical model with provision for adding mass, will be used to predict thermal profiles for AM of the close out. The model will be verified and validated for different material combinations investigated in this study. Keystone will also investigate high temperature stability of the interface Cu-to-Ni layer through thermal treatments. After application of Ni layers and the thermal treatments at varying temperature and times, X-ray diffraction (XRD) will be used to document phases present and analyzed for formation of potential detrimental effects.

Primary U.S. Work Locations and Key Partners





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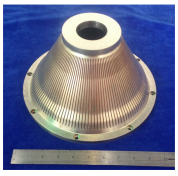
Organizations Performing Work	Role	Type	Location
Keystone Synergistic Enterprises, Inc.	Lead Organization	Industry	Port Saint Lucie, Florida
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama
University of Alabama in Huntsville(UAH)	Supporting Organization	Academia	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Florida

Images



Briefing Chart Image
Bi-Metallic Additive Manufacturing Close-Out of Coolant Channels for Large Liquid Rocket Engine (LRE) Nozzles, Phase I
(https://techport.nasa.gov/image/130137)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Keystone Synergistic Enterprises, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

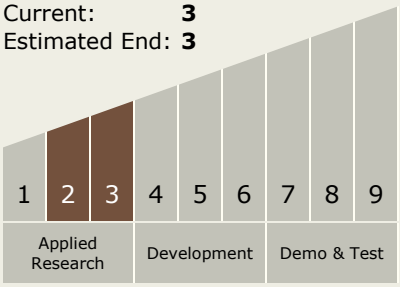
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Bryant Walker

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.4 Manufacturing
    - TX12.4.1 Manufacturing Processes

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System